important American timber trees. This will be much appreciated by students of forestry.—H. N. WHITFORD.

IN A VERY attractive volume Snow[7] discusses the species and properties of a large number of native and foreign species of wood. A valuable feature of the book is the half-tone reproduction of photographs of trees, bark, and wood of many species, usually one plate for each genus that is treated. The work is an untechnical presentation of the subject. It would have been wise to substitute modern terms for "exogenous" and "endogenous" in the text. —H. N. WHITFORD.

NOTES FOR STUDENTS.

SCHMIED reports[8] a carotin dissolved in oil in the periderm of the roots of *Dracaena reflexa*, which is identical in many respects (not in all), with the carotin of Dancus.

IN A WORKING PLAN for some forest lands in South Carolina Sherrard[9] gives data concerning the silvicultural habits of the southern pines in this state.—H. N. WHITFORD.

SCHWARZ[10] thinks the diminished flow of the Rock River is due to the deforestation of large tracts of land in its basin. Cultivated lands and wood lots have been largely converted to pasturage, thus interfering with waterflow. He advises a more careful treatment of the present forest and its enlargement where it will not interfere with land more valuable for agricultural purposes.— H. N. WHITFORD.

CHARPENTIER[11] finds that the green alga, *Cystococcus humicola*, grows luxuriantly in solutions, the air above which is lacking in CO_2. The necessary carbon in such cases may be taken from glucose. The green color may develop in the dark, though growth is less rapid in this condition. When required to depend upon atmospheric CO_2 as a source of carbon, the growth of Cystococcus is very slow.—H. C. COWLES.

A REPORT of the Bureau of Forestry of the Philippine Islands[12] contains

[7] SNOW, H. C. The principal species of wood; their characteristic properties. 8vo. pp. xi + 203. *pls. 39. figs. 4.* New York: John Wiley & Son. 1903. $3.50.

[8] SCHMIED, H., Ueber Carotin in den Wurzeln von Dracaena und anderen Liliaceen Oesterr. bot. Zeits. 53: 313–317. 1903.

[9] SHERRARD, T. H., A working plan for forest lands in Hampton and Beaufort counties, South Carolina. Bull. no. 43, Bureau of Forestry, U. S. Dept. of Agric. pp. 54. *pls. 12. figs. 11. 1 map.* 1903.

[10] SCHWARZ, G. F., The diminished flow of the Rock River in Wisconsin and Illinois, and its relation to the surrounding forests. Bull. no. 44, Bureau of Forestry, U. S. Dept. of Agric. pp. 27. *pls. 6. 2 maps.* 1903.

[11] CHARPENTIER, P. G., Sur l'assimilation du carbone par une algue vertue. Compt. Rend. 134: 671–673. 1902.

[12] REPORT of the Bureau of Forestry of the Philippine Islands from July 1, 1901, to September 1902. pp. 451–527. Report of the Philippine Commission.

some interesting matter concerning the condition of forestry there. There are between 600 and 700 native arboreal species of which there is some information, but there is great confusion in both scientific and popular names. Considerable work has already been done in ascertaining the condition of the forests in various parts of the Island.—H. N. WHITFORD.

ALEX. ARTARI, has been studying the relation of chlorophyll to light in some algae, especially Stichococcus.[13] The development of chlorophyll in the dark is possible only when the nutrition is good. Similarly chlorophyll often vanishes in the light under highly favorable nutrition conditions. Artari thinks that the disappearance of chlorophyll in the phylogenetic development of parasites is thus a matter of nutrition and bears no relation to light. —H. C. COWLES.

NEMEC[14] has compressed the growing apices of shoots of *Nepeta macrantha*, and studied the effects on the leaf primordia. By preventing the growth of one the position of these is usually modified but in one experiment the phyllogenous tissue was extended beyond the normal. As was expected, the number of rows of leaves was not modified. It may be remembered that Vöchting found the number of rows of leaves of some cacti dependent on the illumination and changeable with it.—E. B. COPELAND.

V. KINDERMANN[15] has confirmed the results of Leitgeb and Molisch as to the resistance of guard cells, and added new data. Many agents were employed, such as acids, alkalis, harmful vapors, illuminating gas, desiccation, lack of oxygen, and in every case guard cells are found to be more resistant than other cells. They sometimes remain alive for several days after the death of other leaf cells. The author thinks this resistance is not referable to the cell wall, but is a property of the cytoplasm.—H. C. COWLES.

ED. GRIFFON, whose previous studies on chlorophyll are well known, has reinvestigated some of Boussingault's results,[16] from which it has been commonly supposed that the synthetic power of the palisade cells far exceeded that of the spongy parenchyma in ordinary leaves. The earlier results are confirmed in a general way, though the difference is much less than Boussingault thought. The maximum difference in favor of the palisade was found to show the ratio of 100 to 54 instead of Boussingault's 6 to 1. The ratio is

[13] ARTARI, ALEX., Ueber die Bildung des Chlorophylls durch grüne Algen. Ber. Deutsch. Bot. Ges. **20**: 201–207. 1902.

[14] NĚMEC, B., Ueber den Einfluss der mechanischen Factoren auf die Blattstellung. Bull. Internat. Acad. Sci. Boheme. 1903, pp. 14.

[15] KINDERMANN, V., Über die auffallende Widerstandskraft der Schliesszellen gegen schädliche Einflüsse. Sitzb. Akad. Wiss. Wien. Math.-Nat. Classe, Abth. 1, 111: 490–509. 1902.

[16] GRIFFON, ED., Recherches sur l'assimilation chlorophyllienne des feuilles dont on éclaire soit la face supérieure, soit la face inférieure. Compt. Rend. **135**: 303–305. 1902.

100 to 92 in the almost homogeneous mesophyll of the bamboo leaf.—H. C. COWLES.

THE EMBRYO-SAC of two sterile hybrids is discussed in a recent paper by Tischler.[17] The hybrids are *Ribes Gordonianum* Lem. (*R. aureum* × *sanguineum*) and *Syringa chinensis* (*S. vulgaris* × *persica*). Both parents of *R. Gordonianum* have normal embryo sacs with conspicuous nutritive tissue in the chalazal region of the ovule. In the hybrid this nutritive tissue is lacking and the development of the embryo sac is usually checked long before it reaches the fertilization period, the megaspores often failing to germinate at all.

In the parents of *Syringa chinensis* the nutritive tissue is in the form of a jacket derived from the integument and surrounding the embryo sac, which in both cases is normally developed. In the hybrid the nutritive jacket is more highly developed than in the parents, but the embryo sac becomes disorganized quite early, so that the stage at which fertilization might occur is seldom or never reached.

References are given to the few cases previously described of irregularities and imperfections in the development of the ovules and embryo sacs of sterile hybrids.—C. J. CHAMBERLAIN.

P. D. BUCK [18] has made a comprehensive study of the stomata and aeration tissues of a large number of Swiss plants, especially those of beech woods. A number of modifications of Schwendener's types are described, together with a new type, that of *Ranunculus acer*. Buck describes a number of variations on the same individual, especially differences in the level of the guard cells. While some groups, such as conifers, sedges, and grasses, are characterized by a definite structural type, it is more common to find rather a relation to the form of the leaf, or to the habitat. Perhaps his most interesting contribution deals with subterranean stomata, of which he finds three types: functional, functionless, and latent. The latent stomata attain full development only when the shoot which bears them comes above the surface. For the functional subterranean stomata, Mohl's theory as to the mechanism, of course, cannot be held, as there is no chlorophyll or synthetic activity, though starch is present. They were found to open and close like ordinary stomata when the moisture content of the air was changed. The last section of the paper deals with the spongy parenchyma, of which several types are noted.—H. C. COWLES.

THE U. S. Bureau of Soils in a recent bulletin [19] presents a comprehensive study of the influence of soil chemistry upon crop production. It is shown

[17] TISCHLER, G., Ueber Embryosack-obliteration bei Bastardpflanzen. Beih. Bot. Centralbl. 15 : 408–420. *pl. 5.* 1903.

[18] BUCK, P. D. Beiträge zur vergleichenden Anatomie des Durchlüftungssystems. Inaugural Dissertation. Freiburg i. d. Schw. 1902. pp. 93.

[19] WHITNEY MILTON, and CAMERON, F. K., The chemistry of the soil as related to crop production. Bull. 22, Bureau of Soils. U. S. Dept. of Agric. pp. 71. 1903.

that in practically all cultivable lands no such influence exists. The soil water is at all times nearly saturated with the difficultly soluble minerals of which the soil is composed, and several hundred analyses of water from soils of every type and degree of fertility showed in almost every case that the materials essential for the plant are present in considerable excess of the amount required for the production of good crops. This result agrees well with the observations of students of physiographic ecology, that the chemical composition of the underlying rocks is of little significance in determining the development of vegetation, and it furnishes a sound basis for the explanation of this observed fact. It also emphasizes the importance of the study of soil physics, since it is in the physical properties of the soil that we must find the explanation of the important influences of soil upon vegetation. There are brief chapters upon the influence of climate, of texture of the soil, and rotation upon the yield of crops, and upon the rôle of commercial fertilizers. In an appendix is a concise description of the methods used for the quantitative determination of the various ingredients of soil waters. This will be greatly appreciated because of the simplicity of the apparatus, the ease of manipulation and the accuracy of the results.—G. H. SHULL.

IN THE RUST, *Coleosporium sonchi-arvensis* Lév.[20] during certain stages in the life history the cells contain two nuclei and at other stages but one nucleus. The uredospore and the cells of the mycelium to which it gives rise, contain two nuclei which divide by conjugate division, *i. e.*, each nucleus contributes to each of the two daughter-cells. The teleutospore produced from this mycelium is the last binucleate cell of the series. The two nuclei of the teleutospore fuse, after which the teleutospore at once germinates into a four-celled promycelium, each cell of which contains but a single nucleus. Each of the four-cells of the promycelium produces a uninucleate sporidium. The first division of the nucleus of the sporidium is not followed by cell division, but starting with the sporidium there is developed a mycelium of binucleate cells. In short, from teleutospore to sporidium the cells are uninucleate, and from sporidum to teleutospore, binucleate.

The two nuclei which fuse in the teleutospore have maintained a separate existence throughout almost the entire life cycle of the host, and there is some evidence that the chromosomes, in the division of the fusion nucleus, are collected into two groups representing, possibly, the chromosomes of the male and female nuclei. While there is no proper cell fusion, the union of nuclei more or less separated in origin is not out of harmony with our conception of sexual reproduction in other groups of plants.—C. J. CHAMBERLAIN.

RUHLAND has presented in full[21] the results of his studies on several of

[20] HOLDEN, R. J. and HARPER, R. A., Nuclear divisions and nuclear fusion in *Coleosporium sonchi-arvensis* Lév. Trans. Wis. Acad. Sci. 14: 63–82. *pls. 1–2.* 1903.

[21] RUHLAND, W. VON, Studien über die Befruchtung der *Albugo Lepigoni* und einige Peronosporeen. Jarhb. Wiss. Bot. 39: 135–166. *pls. 2.* 1903.

the Peronosporales.[22] *Albugo Lepigoni* is near the level of *A. candida* in the interesting series of species in this genus, or if anything, more highly specialized, chiefly on account of its extraordinarily large and well differentiated coenocentrum. Ruhland agrees with Berlese and Wager that *Peronospora Alsinearum* has a uninucleate egg and well differentiated coenocentrum; and with Stevens that there is in *Sclerospora graminicola* a rather vague area of denser protoplasm in the center of the egg in place of a clearly defined coenocentrum, though otherwise it is very much like Peronospora. *Plasmopara densa* entirely lacks a coenocentrum and therein differs from *Plasmopara alpina* as recently described by Rosenberg. Ruhland observed a specimen of Plasmopara in which two mature oospores and a younger egg lay side by side, making three differentiated regions of ooplasm in the same oogonium. Such conditions might prove very interesting if one could follow the developmental history.

Ruhland discusses a number of the topics which the reviewer has recently treated in his paper on Saprolegnia. He agrees that the uninucleate egg in the Peronosporales is at a higher level of sexual differentiation than the multinucleate; criticises Trow's comparison of the coenocentrum to a "whirlpool in a river;" holds that the nuclear divisions in the oogonium are not established as reduction divisions; and is not willing to accept Rosenberg's recent comparison of these mitoses to the divisions in the spore mother-cell. —B. M. DAVIS.

A DISCUSSION has arisen over the characters of the genus Monascus. Ikeno[23] calls in question the identity of the form whose ascocarp has been recently described by Barker.[24] Monascus has formerly always been included among the Hemiasci. Barker found in his type a curious but nevertheless well-established system of ascogenous hyphae developing from the fertilized ascogonium, which clearly removes this form from the Hemiasci and so confident was Barker of its identity with other material of the same name that he regarded the entire genus as true Ascomycetes. Ikeno is not able to find ascogenous hyphae in the form which he considers *Monascus purpureus*. The ascogonium develops directly into a large cell, which becomes loosely invested by surrounding hyphae, and the spores arise by free cell formation within this—processes typical of the Hemiasci. Ikeno then holds to the old characters of Monascus and regards Barker's form as entirely distinct from this genus and a typical ascomycete. It is unfortunate that Ikeno does not present a full account of the period when the fertilization of the ascogonium should be expected and the stages of development immediately following this event. This is exactly the time when ascogenous

[22] See notice of preliminary paper, BOT. GAZ. 35:221. 1903.

[23] IKENO, S., Ueber die Sporenbildung und systematische Stellung von *Monascus purpureus* Went. Ber. Deutsch. Bot. Gesells. 21:259–269. 1903.

[24] Ann. Botany 17:167. 1903.

hyphae, if present, would be most easily found. As Barker states, there is little trace of their presence in later stages when the spores are formed. The account of Ikeno is, however, very positive as to the entire absence of ascogenous hyphae, and it is hard to see any place for them in the series of figures that he presents. Barker and Ikeno must either have had very different organisms, or there is a slip somewhere in one of the accounts of these authors.— B. M. DAVIS.

OLIVER[25] characterizes the Paleozoic gymnospermous seeds by the importance and dimensions of the pollen chamber and the complicated vascular system which embraces the body of the nucellus. He considers chiefly the cordaitean genus Stephanospermum, representing Brongiart's Radiosperms, and Cardiocarpus representing the same author's Platysperms, both from the French Permo-carboniferous. The latter possess many cycadean features, such as the relatively small pollen chamber and the thickening of the cells of the beak of the nucellus. They are more archaic, however, than the former. While paleobotanical terminology denominates these remains "seeds," they are usually preserved at a stage just preceding fertilization, and therefore answer to the modern unfertilized ovules. He next considers the genus Lagenostoma from the Lower Coal-measures of Lancashire and Yorkshire, chiefly as exemplified by *Lagenostoma ovoides* of Williamson. It is small and circular, and has a chambered apex with vascular prolongations which are quite unique. It resembles Cycads in the considerable area of "fusion" between the nucellus and testa, as well as in the presence of vascular strands in the plane of fusion. The confined form of the pollen chamber marks an advance in precision on the open type of the ordinary Paleozoic seeds. Modern cycadean structures are considered, as shown in *Cycas Rumphii*, and the paper closes with an examination of the modern species of Torreya, which, though siphonogamous as in all other conifers, still retains marked traces of the fertilizing contrivances that became obsolete when siphonogamy appeared.

Oliver also records[26] the discovery that the *Sporocarpon ornatum* of Williamson is really a transverse section of *Lagenostoma physoides* of the same author.

He also notes[27] a fungus on the fronds of Alethopteris from the Stephanian of Grand Croix, and of chytridineous sporangia in the nucellus layers of Sphaerospermum from the same formation.— E. W. BERRY.

VARIATION in the number of stamens of *Alsine media* L. has been studied during several years by Reinöhl,[28] using a combination of the statistical and

[25] OLIVER, F. W., The ovules of the older gymnosperms. Annals of Botany 17:451–476. *pl. 24, fig. 20.* 1903.

[26] OLIVER, F. W., New Phytologist 2:18. 1903.

[27] OLIVER, F. W., New Phytologist 2:49. 1903.

[28] REINÖHL, FRIEDRICH, Die Variation im Andröcium der *Stellaria media* Cyr. Bot. Zeit. 61[1]:159–200. *pls. 2–4.* 1903.

experimental methods. Field studies showed that the stamens vary from 0 to 13, forming a bimodal curve with principal maximum on 3 and secondary maximum on 5. The relative prominence of the maxima, the value of the mean, and the coefficient of variability depend upon habitat and time at which collections are made. Although in nature the curve was always bimodal, three of the cultures produced asymmetrical monomodal curves which agreed with Pearson's theoretical type IV, in one instance the asymmetry being so slight as to give essentially the Gaussian probable error curve. This reduction to a homogeneous condition is an unusual result where the homotyposis of organs which have their origin in relation to the phyllotactic spiral is involved. The maximum on 5 was found to be completely eliminated in the third generation of plants grown in diffused light, while that on 3 was eliminated by the high manuring of plants which had been observed to have already a strong development of the higher mode. By still higher manuring he secured a curve with a strong maximum on 5 and a slight one on 8, showing thus by the maxima on 3, 5, 8, a perfect agreement with the Schimper-Braun series. Of the external factors light intensity was found to be the most important, and the richness of the soil in available foods next.

Finally it was found that in all cases the modal condition changes as the flowering season advances, the number of stamens beginning low, reaching its maximum only after some time, and falling again near the end of the season. This contravenes Burkill's[29] conclusions, which rest upon occasional collections aggregating less than 400 flowers cultivated in pots in a tropical greenhouse, while Reinöhl has observed 44,542 flowers, including in the case of cultures all the flowers produced during the flowering season. It also differs from observations by the reviewer[30] on *Aster prenanthoides* Muhl., the reason probably being that in *Alsine media* the height of vegetative activity is not reached until some time after the flowers begin to bloom, while in *Aster prenanthoides* the maximum vegetative activity precedes the development of the flowers.—G. H. SHULL.

E. HEINRICHER'S studies of the green half-parasites[31] have advanced considerably the boundaries of our knowledge. It was to have been expected that a group like the Rhinanthaceae, apparently half way on the road to holoparasitism, would yield results of surpassing interest. In his earlier paper Heinricher presents studies on *Odontites Odontites*, *Euphrasia stricta*, and *Orthantha lutea*. He finds that germination is independent of host stimuli, but that haustoria require a host stimulus in order to induce development. Odontites was brought to a state of flower and fruit entirely without parasitic nutrition, while Euphrasia could nourish itself to a much less degree·

[29]BURKILL, On some variations in the number of stamens and carpels. Jour. Linn. Soc. Bot. **31**: 220 *et seq.* 1895.

[30]SHULL, G. H., Amer. Naturalist **36**: 111–152. 1902.

[31]HEINRICHER, EMIL, Die Grünen Halbschmarotzer. Jahrb. Wiss. Bot. **31**: 77–124. 1898; **32**: 389–452. 1898; **36**: 665-752. 1901; **37**: 264–337. 1902.

Any species grows better in dense cultures than alone, showing that stronger individuals grow parasitically upon the weaker. Still stronger individuals result when the normal host plants are supplied. The species which have the greatest autophytic power have abundant root hairs, while the more fully parasitic forms are without them.

In his second paper Heinricher showed that the Rhinanthaceae require light for their development even more than they require a host. Synthesis of carbohydrates was shown by Sachs's iodin test. Various species of Euphrasia differ widely as to their parasitism, some being as independent as Odontites, while some absolutely require a host for full development. His third paper dealt with Bartschia and Tozzia, the forms which come nearest to holoparasitism. In Bartschia haustoria appear in the seedling stage, there are no root hairs, and a bud for the second growth period does not appear unless a host is supplied. Tozzia is the most remarkable form of all. It requires the stimulus furnished by a host root even for germination, differing in this from all other Rhinanthaceae and agreeing with holoparasites like Orobanche and Lathraea. For more than a year the plant lives wholly underground as a holoparasite, while late in the second season a tiny green shoot appears which soon flowers and fruits. Even this plant was shown to have some photosynthetic activity, though less than in any other member of the family. Bonnier found no active photosynthesis in these plants, and more recent authors have been inclined to doubt Heinricher's results. Apparently Heinricher has clinched his case by employing cut shoots and finding synthesis to take place there, although he uses the iodin test rather than the more accurate method of gas determination.

In his last paper Heinricher shows that chlorosis depends upon the lack of iron in the seed, not upon the more complete parasitism of the individual in question, as he at first supposed. In other respects, also, he finds differences in the properties of seeds in the same species, showing that all of one species do not have the same hereditary characters. Wide individual variations are also found to be due to differences of habitat. Strong host plants, for example, permit a better development of parasites. Heinricher is inclined to explain a number of Wettstein's species, especially his aestival and autumnal species, as true habitat variations. As might be expected, this view has called forth a series of polemics[32] which need not be mentioned further.

Heinricher's work gives us a basis for theorizing as to the origin of parasitism, since we find every step in the series within one group of plants. Apparently root hairs are soon lost, the first demand on the host being for raw materials rather than for organized foods. Further parasitism is acquired by drawing upon these organized foods, a process which is ultimately followed by the loss of chlorophyll and photosynthetic power.—H. C. COWLES.

[32] Jahrb. Wiss. Bot. **37**: 685–697. 1902; **38**: 667–688. 1903. Also Oesterr. Bot. Zeits. **52**: 246–249. 1902; **53**: 205–223. 1903.